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ABSTRACT

The regionalization of the University of Washington Medical School represents a beginning in addressing the problem of maldistribution of physician manpower in the states concerned-Washington, Alaska, Montana, Idaho (WAMI). The WAMI experiment uses the faculties and facilities available in the universities of these states to teach first year medical students the first quarter of basic sciences. This paper addresses itself to: (1) describing the philosophy, history, strategies, and activities of the WAMI experiment, (2) identifying the questions that need to be answered by the evaluation process; and (3) progress of the Program and curriculum evaluation to date. (Author)

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EVALUATION OF AN INTERUNIVERSITY PROGRAM

IN

MEDICAL EDUCATION

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BACKGROUND

It is stated that there is a serious shortage of physicians in the United States. It is also a fact that there are more qualified applicants for medical school than there are places available. The ratio approaches two qualified applicants for every available place in 1973. Another fact relative to every state is that it is not feasible, or even desireable to build new schools, nor is it feasible or desireable to increase significantly the size of existing classes at the majority of medical schools.

Coupled with the need for more doctors in the United States is the need for a better distribution of the available physicians. From the map you can see the relative distribution of doctors in the United States. Many states are below the national ratio of 150 doctors per 100,000 population (Figure 5).

The states of Washington, Alaska, Montana, and Idaho are good examples of the difficulty we are trying to describe. The land mass of the four states is equal to 1/4 the land mass of the nation. The geography is mountain, desert, and maritime. The population is approximately 7 million, with concentrations of this population in the greater Seattle area, Anchorage, Spokane, Boise, and Pocatello.

Health care delivery in the area ranges from the most sophisticated in the world in the major metropolitan area to non-existent health care in remote villages. A mere increase in the number of physicians graduating will not guarantee better health care delivery to the remote areas of the region. Chronic maldistribution of physicians as well as the shortage of physicians plagues the region.

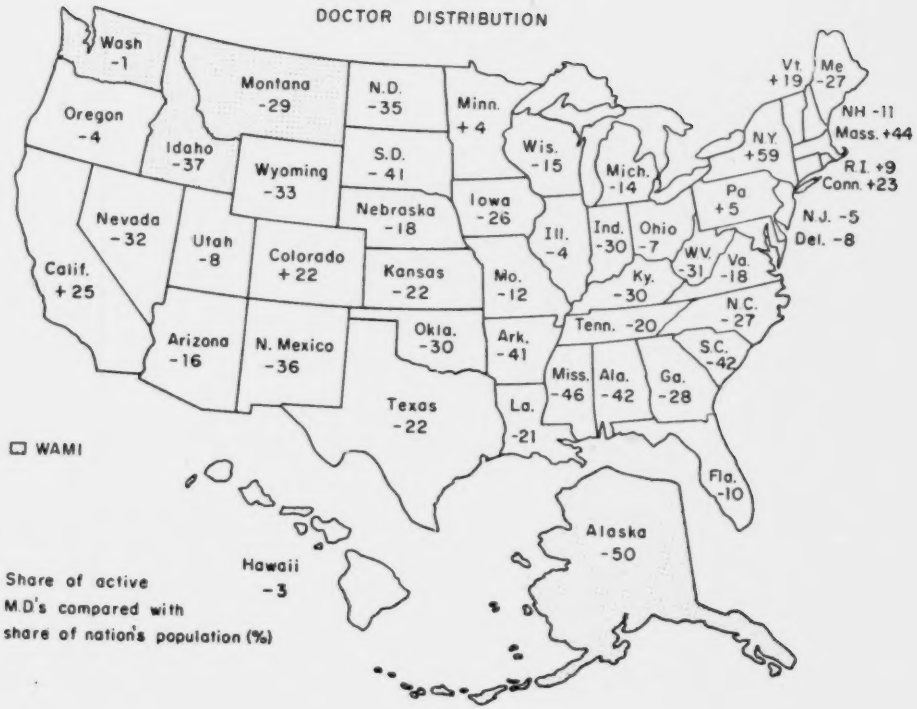


FIGURE 5. PHYSICIAN DISTRIBUTION FOR THE UNITED STATES.

Alaska has only one half of its fair share of physicians based on its population. Idaho has a physician/population ratio of 89/100,000 and Montana's is 100/100,000. Washington's physician population is only slightly less than the national average but most of those physicians gravitate toward the Puget Sound and Spokane areas. This maldistribution of physicians which is seen also in Alaska, Montana and Idaho leaves large rural areas of the state with few physicians and with many significant health care needs.

Consider for a moment the facilities for training physicians in the region. There is a high quality health science complex in Seattle. Alaska, Montana and Idaho do not have medical schools. They do have applicants to medical schools but have a lower ratio of acceptance because states with medical schools tend to keep the majority of their available spaces for their native sons and daughters. Only 8 of the 10,546 students admitted to the 100 medical schools in this country in 1969 were Alaskan residents. In the same year 25 Idaho, and 27 Montana residents were admitted to medical schools. These figures do not represent an increase over the number admitted in 1951 or 1952 in spite of the explosion in undergraduate enrollments during this period.

It would appear that students from these states are being discouraged from applying to medical school. Because of the current reluctance of funding agencies to provide money for new buildings or expansion of existing ones to accomodate more students, a radical departure from the traditional physical milieu of medical education seems necessary. The challenge to medical education is not only to increase the number of physicians from states that have fewer applicants but

also to achieve a better distribution of physicians in areas that now suffer chronic shortage, and all this without devoting significant resources to building new facilities.

This challenge is presently being engaged in the Pacific Northwest in the form of the WAMI Program. WAMI is an acronym formed by using the first letters of the states of Washington, Alaska, Montana and Idaho. It is the brainchild of three deans of the Medical School in Seattle, Dr. M. Roy Schwarz, presently Director of the WAMI Program; Dr. John N. Lein, Associate Dean for Continuing Education; and Dr. August P. Swanson, presently Director of Academic Affairs for the American Association of Medical Colleges.

The idea nurtured in their minds is a new concept in medical education. It is an experimental regionalization of parts of the University of Washington curriculum to the states of Alaska, Montana and Idaho. Fortunately the curriculum at the University of Washington as it now exists, and foreseable modification of it is amenable to the process of peripheralization. Roughly speaking the curriculum falls into two parts: basic science in the first two years and clinical science in the last two years. Parts of the curriculum in basic science can be taught at existing institutions in the states of Alaska, Montana and Idaho. Substantial clinical experience (in several primary care specialities) in the third and fourth years can be provided in the rural areas of the four states by clinicians presently in practice in these areas.

EDUCATIONAL GOALS

The educational goals of the WAMI Program are:

1. To increase the number of students from the WAMI states accepted into Medical School.
2. To utilize existing educational resources in the area, thus obviating the need for building new facilities.
3. To provide educational opportunities and programs in non-metropolitan areas.
4. To maintain quality educational programs in the region.
5. To enhance the quality and availability of health care for all citizens of the WAMI area.

PROGRAM DESCRIPTION

To meet these goals the WAMI Program operates in two phases - the University Phase and the Clinical Phase.

The Clinical Phase provides an opportunity for students in the third and fourth years of Medical School to enroll in clerkships remote from the Seattle area. Clerkships in Family Medicine, Obstetrics/Gynecology, Internal Medicine, Psychiatry and Pediatrics have been or are being developed in small towns scattered throughout the region. Two students go to each clerkship on a six week rotation. Students may take more than one WAMI clerkship. The evaluation of this phase is so different from the evaluation of the University Phase, that

it merits a separate discussion at another time. This paper will concentrate on the University Phase.

The University Phase of the WAMI Program provides students the opportunity of receiving the first quarter of their basic sciences at Universities in the WAMI area. The University of Alaska, Fairbanks, began with 9 students in the Fall of 1971. Washington State University, Pullman and the University of Idaho, Moscow, began in the Fall of 1972. In the Fall of 1973 Montana State University will be the fourth and final university to be involved. All four universities will operate concurrently, each accomodating approximately 10 first year medical students. It is hoped that each university will ultimately provide one full year of the medical school basic science curriculum.

The courses now offered by the participating universities are Biochemistry; Epidemiology; Physiology/Pharmacology; Anatomy/Histology; and Medicine, Health and Society. In addition a preceptorship with local practicing physicians is provided to introduce the student to the practice of medicine in the area.

METHOD

One of the goals of the University Phase is to provide the students at the WAMI Universities with an educational experience at least equivalent to that provided by the University of Washington Medical School. In the form of a question this goal is as follows: Is the educational experience at the peripheral universities equivalent to that provided at the University of Washington?

The challenge to the Office of Research in Medical Education is to find answers to that question. Charged with planning and conducting the evaluation of the WAMI Program in all its educational aspects the office has concentrated on obtaining answers to questions that relate to antecedents, process and outcomes of the WAMI University Phase, generating data in each of the areas and analysing the results.

ANTECEDANTS

Two groups of antecedent questions are questions about courses and faculty and questions about students.

Do the outlying universities have available courses comparable to those available to the University of Washington students and do they have faculty necessary to teach them? These questions were answered on an administrative level. Some comparable courses existed and needed only minor modification to include content specific to medical education. Not having a medicine curriculum, courses in Biochemistry, Anatomy, Histology, Pharmacology, and Physiology did not have a medical orientation. Modifications of these courses provided this orientation. In some cases, new courses were developed and incorporated at the other universities. When additional faculty members were needed at the peripheral sites, they were recruited and supported by the WAMI Program.

Students participating in the WAMI Program must first be admitted to the University of Washington Medical School. They are then selected for the WAMI Program. Applicants to the University of Washington School of Medicine are informed of the WAMI Program and advised that they may either elect or be selected to participate. Native sons and daughters are encouraged to participate at their home state institution. The important question is whether WAMI students differ from their classmates on college grade point averages, MCAT scores, or undergraduate major.

PROCESS QUESTIONS

Process questions deal with the delivery of the curriculum content and the effect participating in the WAMI Program had on faculty and physician-preceptor time.

The content of the curriculum had to be identified. To this end faculty members from all participating universities come together at a retreat to identify content and to specify objectives for that content and to plan for the evaluation of these objectives. The faculty was grouped by course with the member from the University of Washington acting as chairman. These groups identified necessary and sufficient content for their course with varying degrees of success, which is discussed later. From this content outline - called common content - they specified in a general way the objectives for each topic. Questions for each topic objective were constructed and agreed upon and placed in a pool for each course. From this pool a portion of the final exam at each institution

would be constructed. This common test would optimally consist of 50 items chosen at random, but stratified as to course emphasis. Though substantially implemented, departures from this plan did occur and are noted in the section on results. It should be noted that identification of necessary and sufficient content did not preclude a teacher amplifying or expanding his course beyond the agreed upon common areas. There was opportunity for each course to be individually developed and delivered.

Evaluation of course process took the form of

1. Weekly evaluation by students.
2. Reports of visiting faculty from the University of Washington.
3. Questionnaires administered pre and post to faculty, physician preceptors, and students.
4. Student structured interviews.

Weekly evaluation by students provided valuable feedback to faculty on their objectives and the learning process. The visiting faculty program was implemented to decrease any sense of isolation students might have in being separated from classmates in Seattle. Each course had at least one visitor who gave a series of lectures in his subject. He reported his views of how the students were progressing and of how well the WAMI Program was being received by the various institutions.

The faculty and physician/preceptors questionnaires are an attempt to ascertain how the WAMI Program is affecting the faculties time for research and professional development. For the physicians it attempted to find out how the program affected their practice both as to style and size.

Faculty were asked to identify problem areas in the curriculum and in the WAMI Program. They were also asked to indicate their perceptions of the chances for WAMI accomplishing its goals.

Parts of the questionnaires were designed to give a general idea of what faculty and student attitudes were toward the WAMI Program both before the quarter began and after its completion.

OUTCOME QUESTIONS

Outcome Questions in the cognitive area are:

1. Do the WAMI students master the necessary and sufficient content as well as their classmates in Seattle?
2. Are the WAMI students as well prepared in basic sciences as the University of Washington students?
3. Do WAMI students do as well in subsequent course work as their classmates?

The first question was answered by examining the results of the common testing program for evidence of non-comparability of content mastery.

The second question is answered by analyzing scores on National Board Mini Tests at the beginning of the second year and by performance on the National Boards Part I examination at the end of the second year.

Answers to the third question will be gleaned by monitoring each students' progress through medical school paying particular attention to his performance in University of Washington classes.

Outcome Questions in the affective area

If students or faculty are alienated by a program its chances for success are seriously hampered. Consequently it is important to have some measure of the attitudes of participants to the program.

In a general way we asked what the attitudes of students were to the WAMI Program both prior to their experience and after its completion.

This inquiry took the form of a simple questionnaire administered before they began their lectures and on their return to Seattle. They also engaged in a structured interview with University of Washington faculty on their return to Seattle. Important parameters are their enthusiasm for and support of the program as well as their grasp of the goals of the WAMI Program and their perceptions of its chances for attaining these goals.

RESULTS

In this section we wish to emphasize the preliminary and tentative nature of the evaluation thus far. The ultimate questions about maldistribution and increased number of medical students can only be answered as data becomes available. Questions about student's educational experience can only be partly answered now, because several measures become available only as the students reach certain stages in their careers. For the purpose of this paper we are using the class

admitted in the Fall of 1972. Three of the WAMI states were involved in that quarter. [The class admitted in 1971 had only 9 students at one peripheral site - and the data generated is not substantially different from that presented here.]

Antecedent Questions

What are the student inputs to the program?

From Tables I, II, and III you can see that the WAMI Groups do not differ from the entering class as a whole on mean GPA's and mean MCAT scores. Tests yielded no significant values for any of the comparisons. Their undergraduate majors are representative of the academic background of the class as a whole, with Chemistry, Biology and Zoology predominating.

The analysis of student attitude toward the program, pre and post has not yet been completed.

TABLE I

Mean Grade Point Averages

	Science	Total	N
Total Entering Class	3.51	3.52	126
Total WAMI Student Class	3.53	3.50	30
Group 1	3.58	3.57	11
Group 2	3.57	3.49	9
Group 3	3.42	3.40	10
U of W Class	3.52	3.52	96

TABLE II

Mean MCAT Scores

	Verbal Ability	Quanlitative Ability	General Information	Science	N
Total Entering Class	581	642	575	597	126
Total WAMI Class	568	629	569	596	30
Group 1	595	663	595	604	11
Group 2	545	609	549	596	9
Group 3	559	606	558	585	10
U of W Class	584	647	577	597	96

TABLE III

Undergraduate Majors

Major	U of W Class	WAMI Class
Liberal Arts	11	0
Biochemistry	7	1
Biology & Chemistry	1	1
Biology	34	7
Biological Science	2	0
Chemistry	19	4
Engineering	4	2
Mathematics	3	0
Microbiology	3	1
Natural Science	1	1
Physical Sciences	6	0
Premedicine	5	2
Psychology	7	2
Zoology	15	6
No Major	1	1
Other	4	0
Pathology	1	0
Science (other than above)	2	0
TOTAL	126	30

Process Questions

The students evaluated their course on a weekly basis. The information from these written evaluations is used to plan the courses for the following year. It is also valuable feedback to the faculty on their objectives and demands. On the basis of this information further modification of some courses was undertaken. The general consensus was that the courses were well delivered at all sites.

Students at the peripheral sites may tend to feel isolated from their classmates and from the University of Washington Medical School. To counter this feeling of isolation a program of visiting faculty from the University of Washington was initiated. Faculty from each course visited the institution and delivered lectures in their areas. They interacted with students and faculty outside of classes and reported no significant problems with course delivery or content. Some minor problems were reported and these lent support to students appraisal of course conduct.

Faculty and faculty-preceptor questionnaires were administered before and after the quarter began. Tables IV and V are examples of this questionnaire with mean responses included, pre-scores (X) on top of the lines, post-scores (Y) below the lines. Few significant differences were found.

TABLE IV

PRECEPTOR QUESTIONNAIRE

Date_____

Name_____

Institution_____

Position_____

Major Teaching Responsibility_____

WAMI Course(s) Taught_____

How may Semesters or Quarters have you been involved in the WAMI Program? (Indiate "0" if this is the beginning of your 1st Semester or Quarter)

_____ Semester

or

_____ Quarters

Number of Preceptees you have: _____

As you consider this year's involvement in the WAMI program, what are your general reactions to that involvement? On each line below a continuum is defined by the pairs of words - one on either end. Place a check mark on a space on each continuum which corresponds most closely to your reaction to your involvement in the WAMI Program.

	1	2	3	4	5	
Enthusiastic	x/y					Hostile
Optimistic	x/y					Pessimistic
Apprehensive			x	y		Calm
Satisfied		x/y				Dissatisfied *
Excited		x/y				Bored
Favorable	x/y					Unfavorable

Additional comments: In particular, reasons for positive and/or negative shifts in your reactions since they were last solicited (not applicable for initial reactions)

How well informed do you feel you are on the broad objectives of the WAMI Program?

Well informed		x/y				Ignorant

Some of the WAMI goals are listed below. Based on your present knowledge and attitude, what is your opinion concerning the potential of the WAMI Program to achieve those goals? Indiate your opinion of the potential by making a check under the appropriate column where the column heading have the following meanings?

VH - Potential for attaining the objective is Very High or almost certain
H - Potential is High, but not certain
M - There is a moderate chance of obtaining the objective
L - There is a low chance of achieving the objective
VL - The chance of the objective is Very Low or nearly non-existant

Goals	VH	H	M	L	VL
1. To achieve a better distribution of physicians in the region		x/y			
2. To increase the number of physicians in the region		x/y			
3. To reduce the necessity for duplicate medical education facilities in the region		x/y			
4. To increase the quality of physicians in the region		x/y			
5. To increase the number of students from participating states accepted into med school.		x/y			

TABLE IV (continued)

What required quantitative changes in your professional responsibilities have you experienced (or anticipate experiencing) as a result of participation in the WAMI Program. Please feel free to comment after each item. Use the back of this sheet if you need more room.

	Greatly Increased	Somewhat Increased	No Change	Somewhat Reduced	Greatly Reduced
1. Patient contact hours			x/y		
2. Hours spent in hospital			x/y		
3. Time spent on rounds			x/y		
4. Study hours			x/y		
5. Teaching		x/y			
6. Continuing Education		x/y			
7. Number of Journals read			x/y		

Other required changes in your responsibilities. (specify kind and amount of change)

What qualitative changes have you experienced (or anticipate experiencing) as a result of participation in WAMI. Feel free to make an explanatory comment after each item. Use space on the back if necessary.

	Greatly Increased	Somewhat Increased	No Change	Somehwat Reduced	Greatly Reduced
1. Quality of patient care			x/y		
2. Quality of patient records			x/y		
3. Quality of patient progress notes			x/y		
4. Level of competence exhibited			x/y		
5. Preparation for rounds			x/y		
6. Cooperation and stimulation of colleagues (in teaching effort)		x/y			

TABLE IV (continued)

In general, what is your judgement of the reaction of your colleagues who are not in the WAMI program to the participation of your clinic in the WAMI program (check by position on the continuum defined by the adjective pairs which is closest to your judgement).

Non-participating colleagues reaction to WAMI Program

Enthusiastic	_____	_____x_____y	_____	_____	_____	Hostile
Optimistic	_____	_____y	_____x_____	_____	_____	Pessimistic *
Apprehensive	_____	_____	_____	_____x_____y	_____	Calm
Aware	_____	_____x_____y	_____	_____	_____	Unaware
Excited	_____	_____	_____x_____y	_____	_____	Bored *
Cooperative	_____	_____x_____y	_____	_____	_____	Uncooperative

Additional Comments:

In general, what is your judgement of the reaction of University Faculty in your community to the WAMI Program:

Reaction of Physicians to WAMI Program

Enthusiastic	_____	_____x_____y	_____	_____	_____	Hostile
Optimistic	_____	_____x_____y	_____	_____	_____	Pessimistic
Apprehensive	_____	_____	_____	_____x_____y	_____	Calm
Excited	_____	_____x_____y	_____	_____	_____	Bored
Aware	_____	_____x_____y	_____	_____	_____	Unaware
Cooperative	_____x_____y	_____	_____	_____	_____	Uncooperative

Additional Comments:

TABLE IV (continued)

Please use this space to comment on problems you anticipate or have had as a result of your participation in the WAMI Program.

TABLE V

FACULTY QUESTIONNAIRE

DATE _____

NAME: _____ INSTITUTION _____ POSITION _____

MAJOR TEACHING RESPONSIBILITY _____

WAMI COURSE (COURSES) TAUGHT _____

How many semesters or quarters have you been involved in the WAMI Program (indicate 0 if this is the beginning of your first semester or quarter)

_____ semesters
or _____ quarters

As you consider this year's involvement in the WAMI Program, what are your general reactions to that involvement? On each line below a continuum is defined by the pairs of words - one on either end. Place a check mark on a space on each continuum which corresponds most closely to your reaction to your involvement in the WAMI Program.

	1	2	3	4	5	
Enthusiastic	x y					Hostile
Optimistic	x y					Pessimistic
Apprehensive				x y		Calm
Satisfied	x y					Dissatisfied
Excited	x y					Bored
Favorable	x y					Unfavorable

Additional comments: In particular, reasons for positive and/or negative shifts in your reactions since they were last solicited (not applicable for initial reactions):

How well informed do you feel you are of the broad objectives of the WAMI Program?

Well Informed	y	x				Ignorant *

Some of the WAMI goals are listed below. Based on your present knowledge and attitude, what is your opinion concerning the potential of the WAMI Program to achieve those goals? Indicate your opinion of the potential by making a check under the appropriate column where the column headings have the following meanings:

VH - potential for attaining the objective is Very High or almost certain
H - potential is High, but not certain
M - there is a moderate chance of obtaining the objective
L - there is a Low chance of achieving the objective
VL - the chance of the objective is Very Low or nearly non-existant

Goals

	VH	H	M	L	VL
1. To achieve a better distribution of physicians in the region		x y			
2. To increase the number of physicians in the region		x y			
3. To reduce the necessity for duplicating medical education facilities in the region		x y			

TABLE V (continued)

Goals, Continued

	VH	H	M	L	VL
4. To increase the quality of health care delivery in the region by emphasizing continuing medical education	____ x/y	____	____	____	____
5. To increase the number of students from participating states accepted into medical school	____ x/y	____	____	____	____

What required quantitative changes in your professional responsibilities have you experienced (or anticipate experiencing) as a result of participation in the WAMI Program. Please feel free to comment after each item. Use the back of this sheet if you need more room.

	Greatly Increased	Somewhat Increased	No Change	Somewhat Reduced	Greatly Reduced
1. Classroom contact hours	____	____ x/y	____	____	____
2. Total classroom student load	____	____ x/y	____	____	____
3. Student advising	____	____ x/y	____	____	____
4. Committee responsibilities	____	____ x/y	____	____	____
5. Research effort	____	____	____ x/y	____	____
6. Service to other departments and to outside agencies	____	____ x/y	____	____	____

Other required changes in your responsibilities. (Specify kind and amount of change):

What qualitative changes have you experienced (or anticipate experiencing) as a result of participation in WAMI. Feel free to make an explanatory comment after each item. Use space on the back if necessary.

	Greatly Increased	Somewhat Increased	No Change	Somewhat Reduced	Greatly Reduced
1. Attention to specification of instructional objectives	____	____ x/y	____	____	____
2. Sensitivity to student reaction	____	____ x/y	____	____	____
3. Quality of evaluation procedures	____	____ x/y	____	____	____
4. Quality or organization of instructional objectives	____	____ x/y	____	____	____

	Greatly Increased	Somewhat Increased	No Change	Somewhat Reduced	Greatly Reduced
5. Preparation in background material		x y			*
6. Amount of laboratory equipment			x y		
7. Amount of visual and written instructional material		x y			
8. Cooperation and stimulation of colleagues (in teaching effort)		x y			

Research:

1. Time available for research				x y	
2. Student assistance in research efforts				x y	
3. Material (equipment) for research efforts			x y		
4. Interest in research (yours)		x y			
5. Cooperation and stimulation of colleagues in research effort		x y			

In general, what is your judgment of the reaction of your colleagues who are not in the WAMI Program to the participation of your institution in the WAMI Program (check by position on the continuum defined by the adjective pairs which is closest to your judgment).

Non-participating colleagues reaction to WAMI Program

Enthusiastic		x y				Hostile
Optimistic		x y				Pessimistic
Apprehensive				x y		Calm
Aware			x y			Unaware *
Excited		x y				Bored
Cooperative		x y				Uncooperative

TABLE V (continued)

In general, what is your judgment of the reaction of physicians in your community to the WAMI Program:

Reaction of Physicians to WAMI Program

Enthusiastic		x/y				Hostile
Optimistic		x/y				Pessimistic
Apprehensive				x/y		Calm
Excited	x/y					Bored
Aware		x/y				Unaware *
Cooperative		x/y				Uncooperative

How would you judge the effects on your institution resulting from involvement in the WAMI Program? Please respond to the specific aspects listed below and then add any other comments you may have. Please check the blank which comes closest to your judgment.

	Greatly Improved	Somewhat Improved	No Change	Somewhat Weakened	Greatly Weakened
Institutional Aspect					
1. Quality of instructional material:					
In the sciences		x/y			
In the institution at large		x/y			
2. Quality of instructional methods:					
In the sciences		x/y			
In the institution at large		x/y			
3. Quantity of instructional materials		x/y			
4. Intellectual stimulation		x/y			
5. Interaction with colleagues within institution		x/y			
6. Interaction with colleagues between institution		x/y			
7. Interaction with individuals in the medical community		x/y			

Listed below are some possible problem areas in the WAMI cooperative effort. Please use your judgment to rate present or potential seriousness of the problem areas listed on the 5-point scale provided. Then, please add other problems and their degree of seriousness. Respond from the point of view of the course or courses you teach in the WAMI Program.

	Not Serious	Extent of Problem			Serious
	1	2	3	4	5
1. Mixture of WAMI and non-WAMI students in same course	x y				
2. The coordination of quarter and semester systems		x y			
3. Time constraints in achieving course objectives		x y			*
4. Class size too large to achieve course objectives	x y				
5. Discrepancy in course objectives for WAMI and non-WAMI students		x y			
6. Coordination among WAMI institutions		x y			
7. Communication among faculty members in WAMI institutions		x y			

Other (please specify)

_____

_____

_____

If you have judged certain problems to be serious, we would appreciate any proposed solution you may have. (You are not obligated to propose a solution here but we encourage you to do so.) Please identify the problem (from those above) before presenting your suggestion.

Outcome Questions

Only the first outcome question can be studied at this time - did the WAMI students master the necessary and sufficient content as well as their classmates in Seattle? You will remember that five courses and a preceptorship were offered and each one necessitates some discussion here.

For each course, except Medicine, Health and Society and the preceptorship, a common test was devised. By common we mean that the same set of items in each subject was given to all students, both at the peripheral sites and at the University of Washington.

This common test was planned at a faculty retreat in August, 1972. Faculties involved in the courses came together with their counterparts from each institution involved and identified necessary and sufficient content for each course. This necessary and sufficient content was labeled "common content." Each institution was free to add to or amplify this content. Then the faculties, working together, constructed test items for the objectives of all common content emphasis. The final set of items, consisting of items randomly selected from each of the strata, was sent to each institution for inclusion in their final exam. The plan was to have at least 50 items for each exam, and to add to the pool as the quarter or semester progressed. Some departures from this plan are described under each course heading below.

Biochemistry

At the faculty retreat a pool of 58 items was constructed. Problems associated with such a small pool were avoided when all faculties agreed that the

American Chemistry Association's cooperative test in Biochemistry, Form A was appropriate for the content and objectives of the course.

The ACS test is an 80 item multiple choice exam with 4 choices for each question. The student's score is corrected for guessing by the usual formula. National norms are available for most of the ACS tests, but have not been compiled for Form A of the Biochemistry test yet. An item analysis showed the test to have a reliability index of .80 (Kuder-Richardson 20) for this group with five items being consistently omitted.

Figure 1.1 is frequency distribution of scores for this exam by all the students.

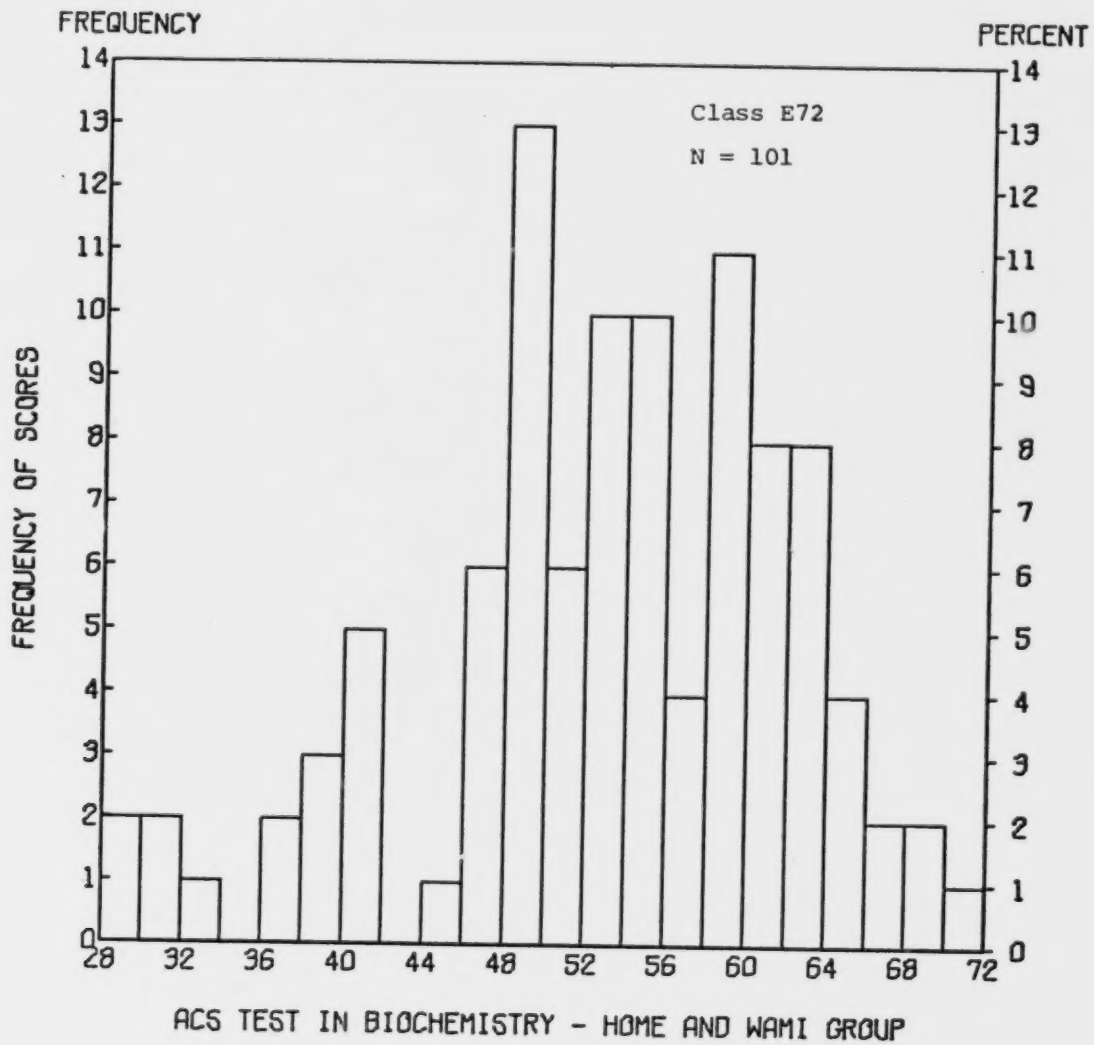
Figure 2.1 is a curve from which a percentile equivalent for any given score can be read.

Table 6.1 is the Analysis of Variance table for the WAMI group and the University of Washington group. An F-ratio of this low magnitude (.0111) indicates that there is no evidence that there is a difference between the means of the groups represented by these students.

Table 6.2 is the Analysis of Variance for the four groups - 3 WAMI groups and the University of Washington.

Again the F-ratio (.2617) is significant. None of the group means differ significantly from any of the others.

On the basis of this information it was concluded that all groups mastered the Biochemistry content at the same level and no further analysis was performed.



(52.68,9.208) 101 VALUES

FIGURE 1.1 - FREQUENCY DISTRIBUTION OF SCORES FOR ACS TEST IN BIOCHEMISTRY

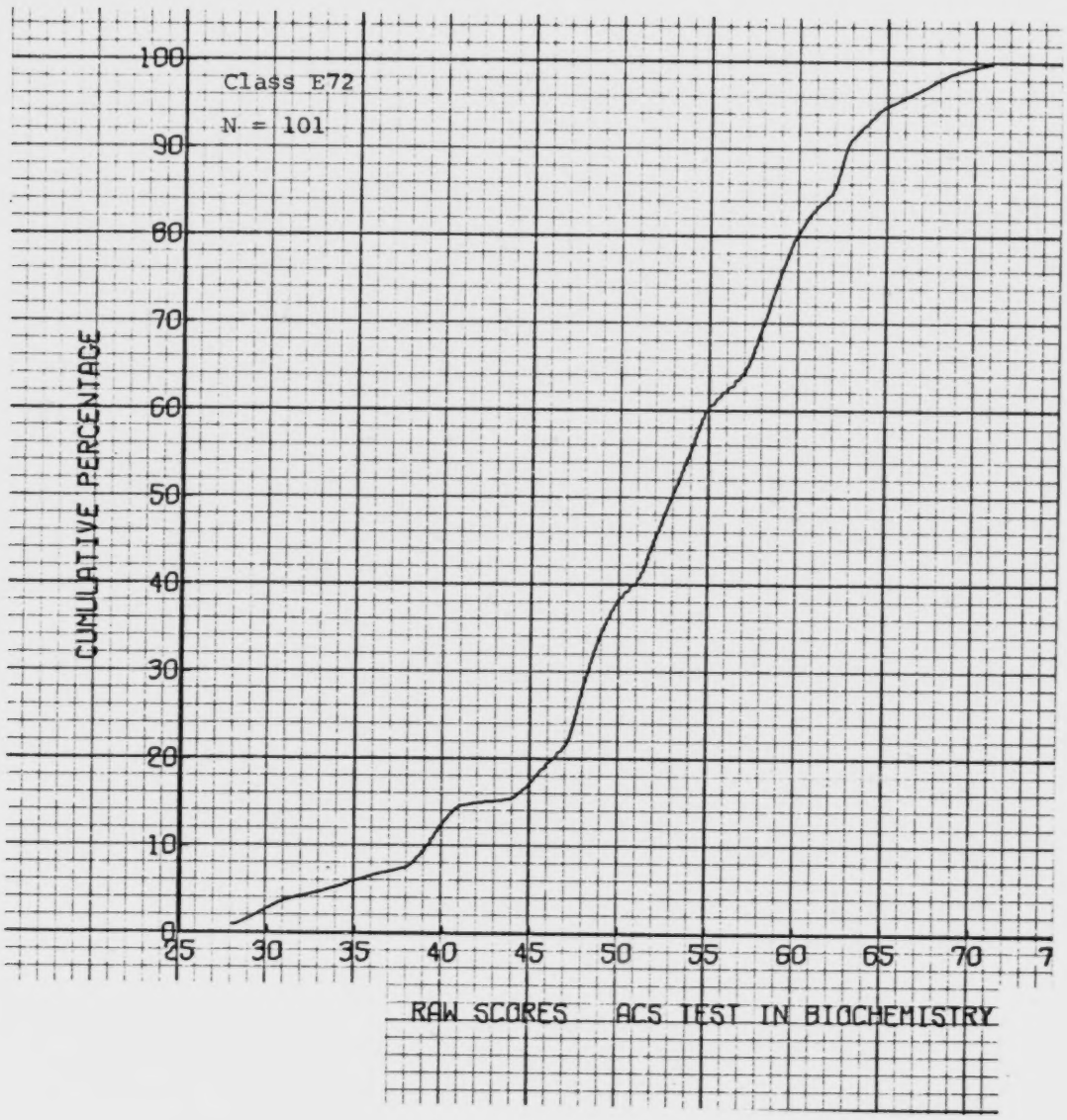


FIGURE 1.2 - PERCENTILE RANKS OF SCORES FOR TEST IN BIOCHEMISTRY

TABLE 6.1

ANALYSIS OF VARIANCE FOR BIOCHEMISTRY - PERIPHERAL SITES AND U OF W

		U OF W
Treatment Group	1	2
Sample Size	30	71
Mean	52.833	52.620
Standard Deviation	8.611	9.571

ANALYSIS OF VARIANCE

	SUM OF SQUARES	DF	MEAN SQUARE	F RATIO
Between Groups	.9623	1	.9623	.0111
Within Groups	8562.8991	99	86.4838	
TOTAL	8563.8614	100		

TABLE 6.2

ANALYSIS OF VARIANCE FOR BIOCHEMISTRY - PERIPHERAL SITES AND U OF W

Treatment Group	1	2	3	U OF W 4
Sample Size	9	10	11	71
Mean	54.444	50.800	53.364	52.620
Standard Deviation	4.558	10.086	10.003	9.571

ANALYSIS OF VARIANCE

	SUM OF SQUARES	DF	MEAN SQUARE	F RATIO
Between Groups	68.7613	3	22.9204	.2617
Within Groups	8495.1001	97	87.5784	
TOTAL	8563.8614	100		

Anatomy

A common test was compiled from over one hundred questions composed at the faculty retreat. The sample of 53 items was sent to each institution. Five items were eliminated resulting in a common test consisting of 48 items. This common test was incorporated into the final exam in Anatomy at each institution. No criterion for passing was set as this was only a part of the final exam.

An item analysis of this common test yielded a reliability index of only .48 (Kuder-Richardson 20). No items were consistently omitted.

It is recognized that the low reliability will result in a statistical test with relatively low precision. It is expected that the reliability will be increased as the item pool is refined.

Table 7.1 is the Analysis of Variance table for this exam for WAMI and the University of Washington, as can be seen a significant F-ratio (25.6863) is obtained, indicating that the means for the groups differ.

Table 7.2 is the Analysis of Variance table for 4 groups. Since the F-ratio is significant (9.496), Scheffe's method of making comparisons among means was applied.

Table 7.3 is the Matrix of Comparisons among means on the Anatomy common test. An asterisk indicates significant differences. Scheffe's method was applied to each pair of means. Means two, three and four differed from mean one, but not from each other. This provides evidence that the WAMI groups have mastered the common content for Anatomy better than the University of Washington. The source of this apparent superiority of the groups at the peripheral sites

has not been fully identified, though there is some indication that it is due to the broader courses being offered at the peripheral sites.

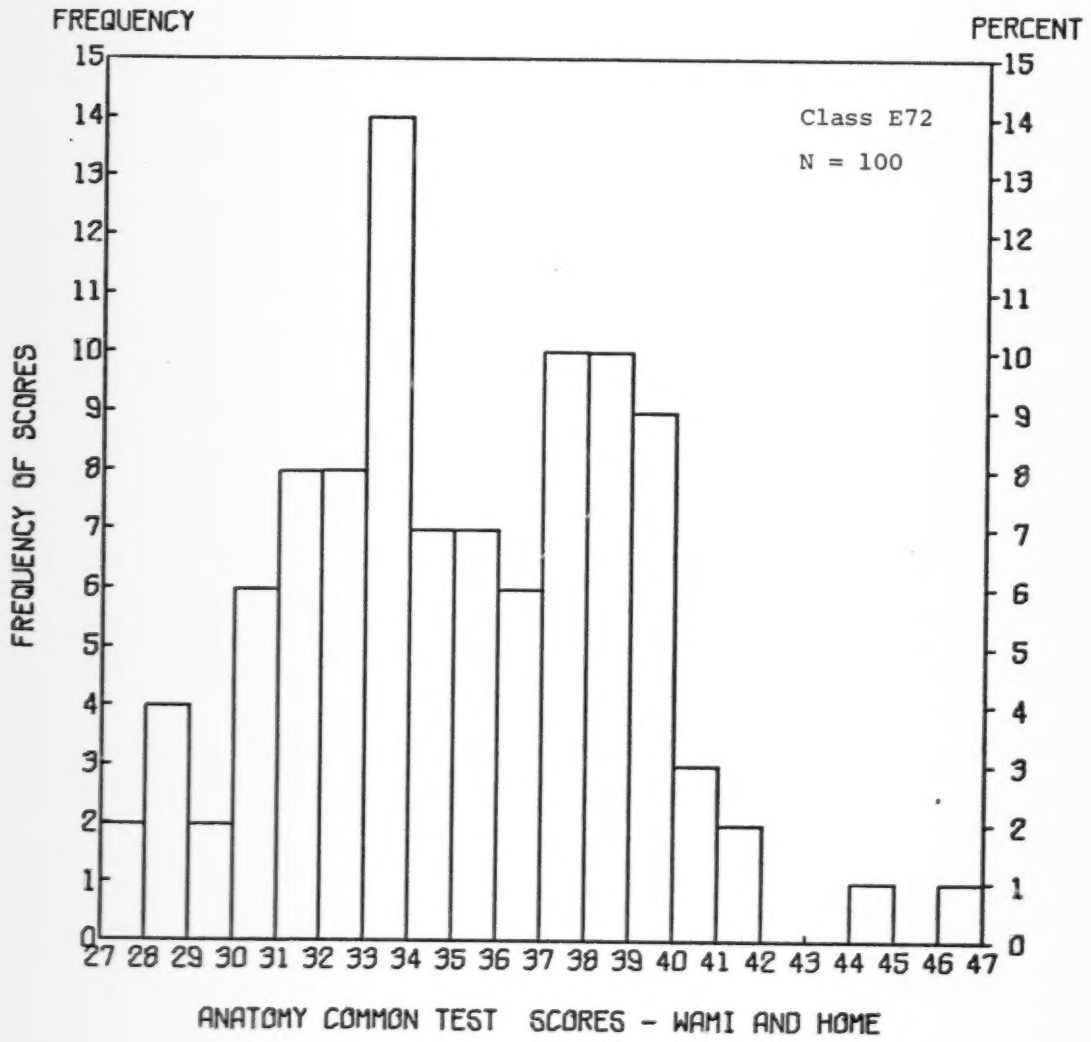


FIGURE 2.1 - FREQUENCY DISTRIBUTION OF SCORES FOR ANATOMY COMMON TEST 1972

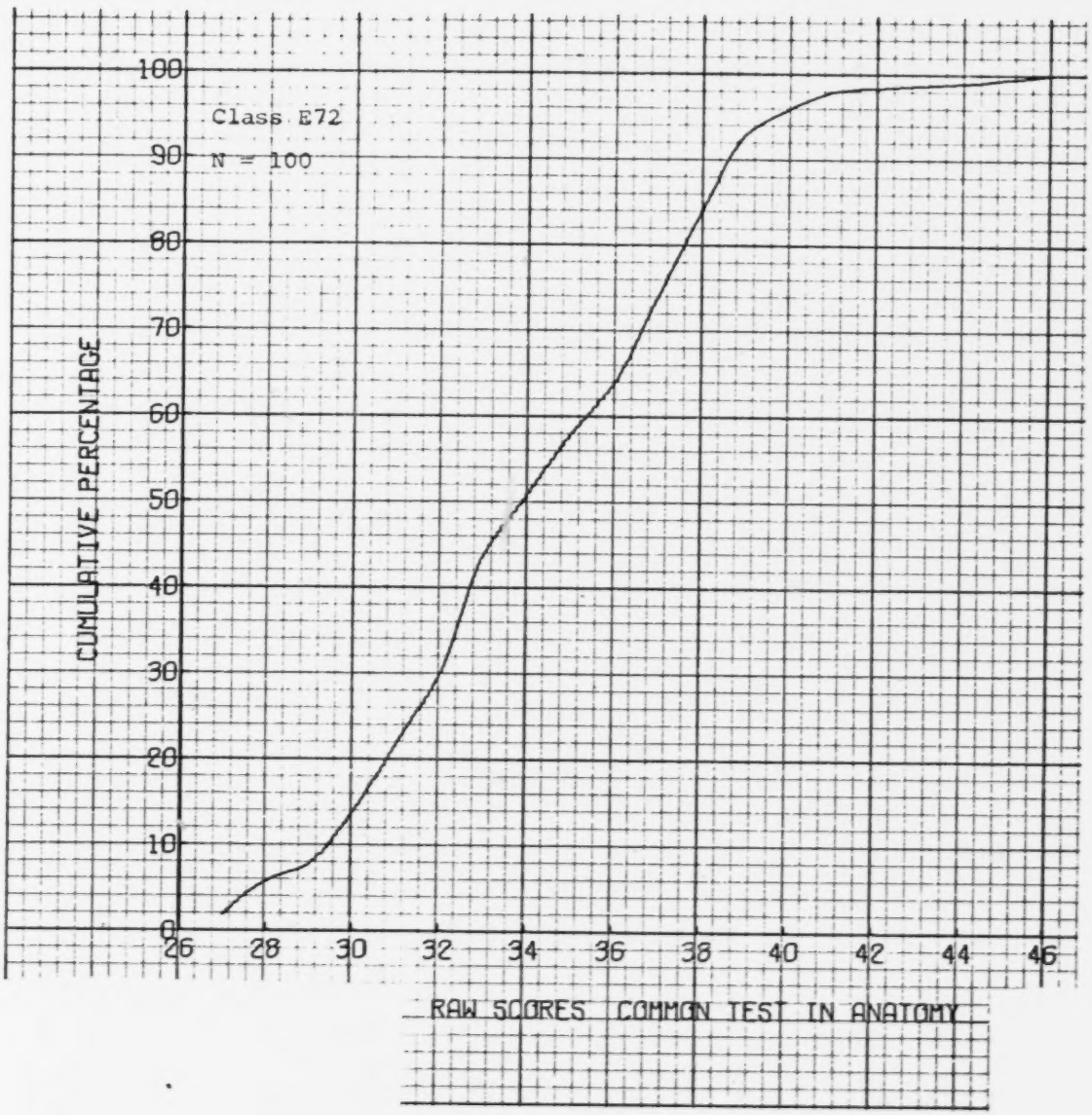


FIGURE 2.2 - PERCENTILE RANKS OF SCORES FOR ANATOMY COMMON TEST

TABLE 7.1

ANALYSIS OF VARIANCE FOR ANATOMY COMMON TEST - PERIPHERAL SITE AND U OF W 1972

	WAMI	U OF W
Treatment Group	1	2
Sample Size	29	71
Mean	37.310	33.521
Standard Deviation	2.714	3.629

ANALYSIS OF VARIANCE

	SUM OF SQUARES	DF	MEAN SQUARE	F RATIO
Between Groups	295.6348	1	295.6348	25.6863
Within Groups	1127.9252	98	11.5094	
TOTAL	1423.5600	99		

TABLE 7.2

ANALYSIS OF VARIANCE FOR ANATOMY COMMON TEST - PERIPHERAL SITE AND U OF W

1972

Treatment Group	1	2	3	U OF W 4
Sample Size	9	10	10	71
Mean	36.778	36.400	38.700	33.521
Standard Deviation	2.587	2.951	2.214	3.629

ANALYSIS OF VARIANCE

	SUM OF SQUARES	DF	MEAN SQUARE	F RATIO
Between Groups	325.7861	3	108.5954	9.4966
Within Groups	1097.7739	96	11.4351	
TOTAL	1423.5600	99		

TABLE 7.3

MATRIX OF COMPARISONS AMONG MEANS FOR ANATOMY COMMON TEST

1972

			$\bar{X}_1$	$\bar{X}_2$	$\bar{X}_3$	U OF W $\bar{X}_4$
U OF W	$\bar{X}_1$	33.52	-	2.82	3.28	5.18*
	$\bar{X}_2$	36.40	-	-	.38	2.30
	$\bar{X}_3$	36.78	-	-	-	1.92
	$\bar{X}_4$	38.70	-	-	-	-

Physiology/Pharmacology

A pool of 120 items was constructed at the faculty retreat. From this pool 40 items were randomly selected, stratified as to content emphasis and included on the final exam for this course at each site.

An item analysis gave a reliability index of .62 (Kuder-Richardson 20). No items were consistently omitted.

Table 8.1 and 8.2 are the Analysis of Variance tables for the WAMI groups and the University of Washington. A significant F-ratio (20.1926) was obtained indicating that the groups may differ.

Table 8.3 is the Matrix of Comparisons means using Scheffe's method. An asterisk indicates a statistically significant difference.

The interpretation is that the group 3 did not master the content as well as the University of Washington group. The University of Washington and groups 1 and 2 mastered the common content equally well.

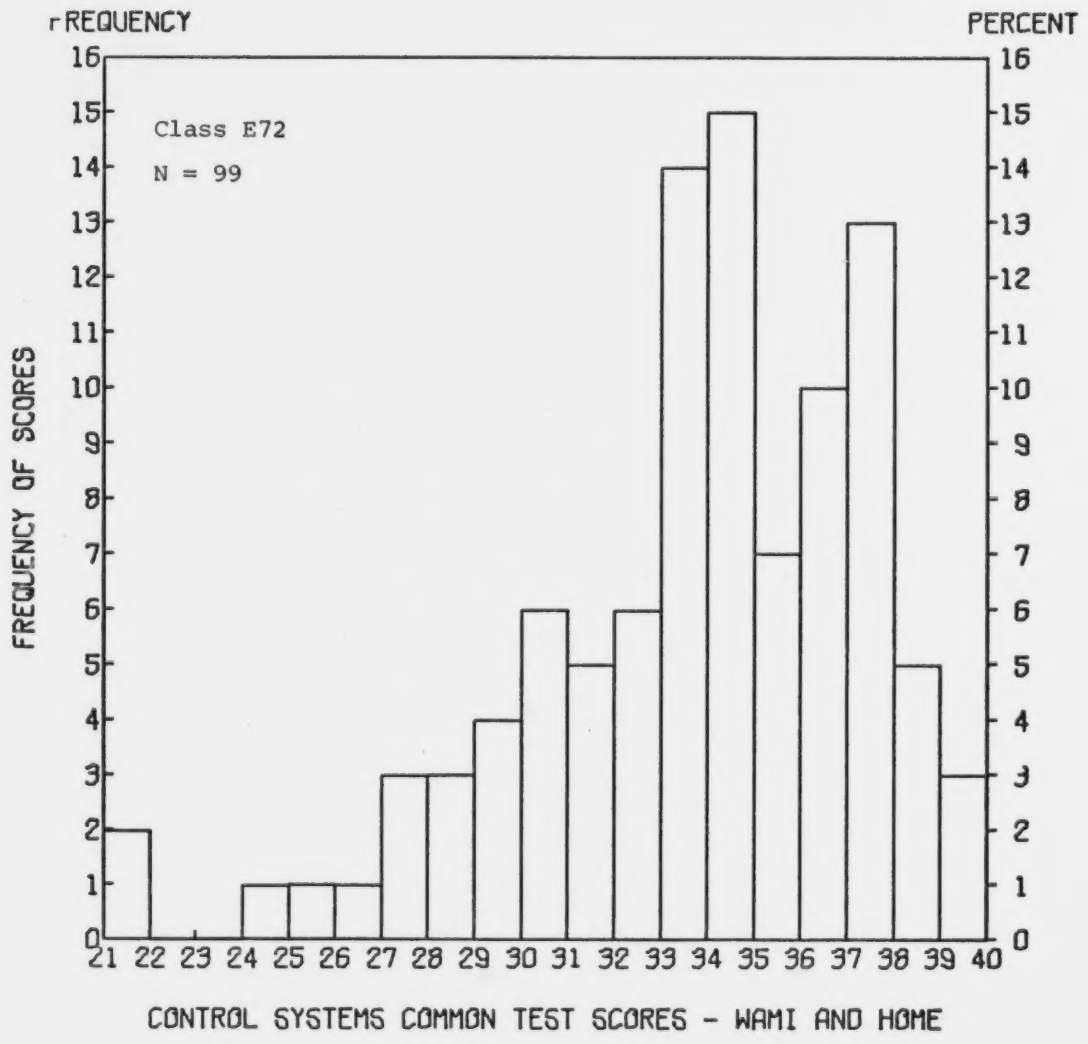

rREQUENCY
PERCENT
Class E72
N = 99
FREQUENCY OF SCORES
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40
CONTROL SYSTEMS COMMON TEST SCORES - WAMI AND HOME
(33.23.3.73) 99 VALUES

FIGURE 3.1 - FREQUENCY DISTRIBUTION OF SCORES FOR PHYSIOLOGY/PHARMACOLOGY 1972

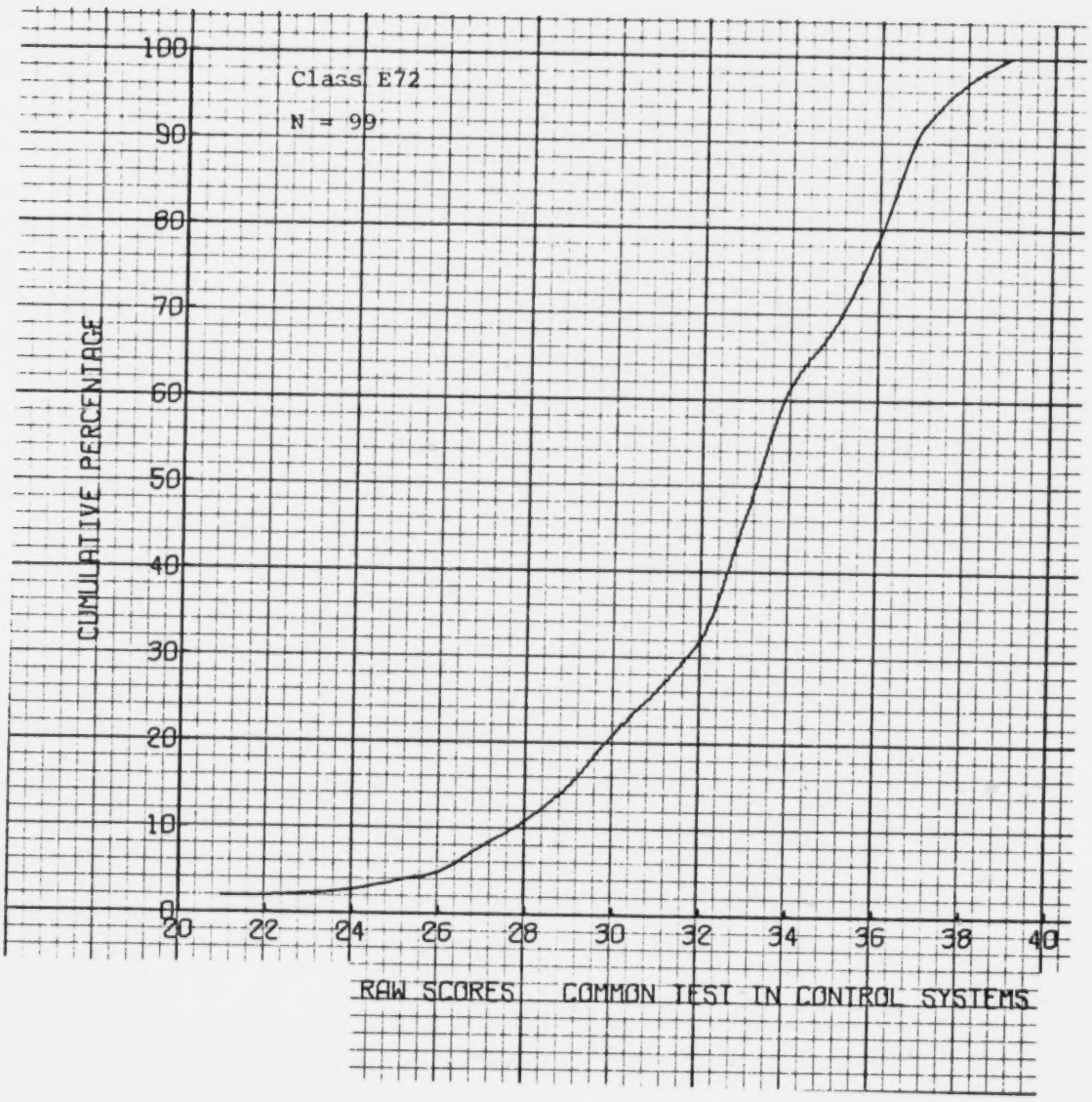


FIGURE 3.2 - PERCENTILE RANKS OF SCORES FOR PHYSIOLOGY/PHARMACOLOGY COMMON TEST 1972

TABLE 8.1

ANALYSIS OF VARIANCE FOR PHYSIOLOGY/PHARMACOLOGY COMMON TEST PERIPHERAL SITE AND U OF W

		U OF W
Treatment Group	1	2
Sample Size	27	72
Mean	30.704	34.181
Standard Deviation	4.084	3.155

ANALYSIS OF VARIANCE

	SUM OF SQUARES	DF	MEAN SQUARE	F RATIO
Between Groups	237.3742	1	237.3742	20.1926
Within Groups	1140.2824	97	11.7555	
TOTAL	1377.6566	98		

TABLE 8.2

ANALYSIS OF VARIANCE FOR PHYSIOLOGY/PHARMACOLOGY COMMON TEST SCORES
PERIPHERAL SITE AND U OF W

				U OF W
Treatment Group	1	2	3	4
Sample Size	9	7	11	72
Mean	32.000	32.286	28.286	34.181
Standard Deviation	5.339	2.059	3.171	3.155

ANALYSIS OF VARIANCE

	SUM OF SQUARES	DF	MEAN SQUARE	F RATIO
Between Groups	317.0298	3	105.6766	9.4654
Within Groups	1060.6268	95	11.1645	
TOTAL	1377.6566	98		

TABLE 8.3

MATRIX OF COMPARISONS AMONG MEANS FOR PHYSIOLOGY/PHARMACOLOGY COMMON TEST SCORES

			$\bar{X}_1$	$\bar{X}_2$	$\bar{X}_3$	U OF W $\bar{X}_4$
	$\bar{X}_1$	28.64	-	3.36	3.65	5.54*
	$\bar{X}_2$	32.00	-	-	.286	2.18
	$\bar{X}_3$	32.29	-	-	-	1.89
U OF W	$\bar{X}_4$	34.18	-	-	-	-

Biostatistics and Epidemiology

A pool of more than 150 items was constructed at the faculty retreat. From this pool of items the chairman of the course at the University of Washington constructed a 35 item common portion of the final exam. While these were mostly of a multiple choice type several were short answer questions. Ten of the multiple choice items had several correct answers and students were expected to indicate all correct choices. An item analysis of this test has not yet been completed. For the purpose of comparing the groups the students' answer sheets were rescored with one point for each totally correct answer. Some of the short answer questions were reconstructed into dichotomously scored items. The exam as reconstructed for comparison consisted of 40 items.

Further problems with this test surfaced after its administration. Some instructors viewed some questions as ambiguous and reworded them for their site only. One site did not have an open book exam while all the others did.

Frequency distributions of answers to each item are being prepared for the faculty to aid them in preparing the common test for next year.

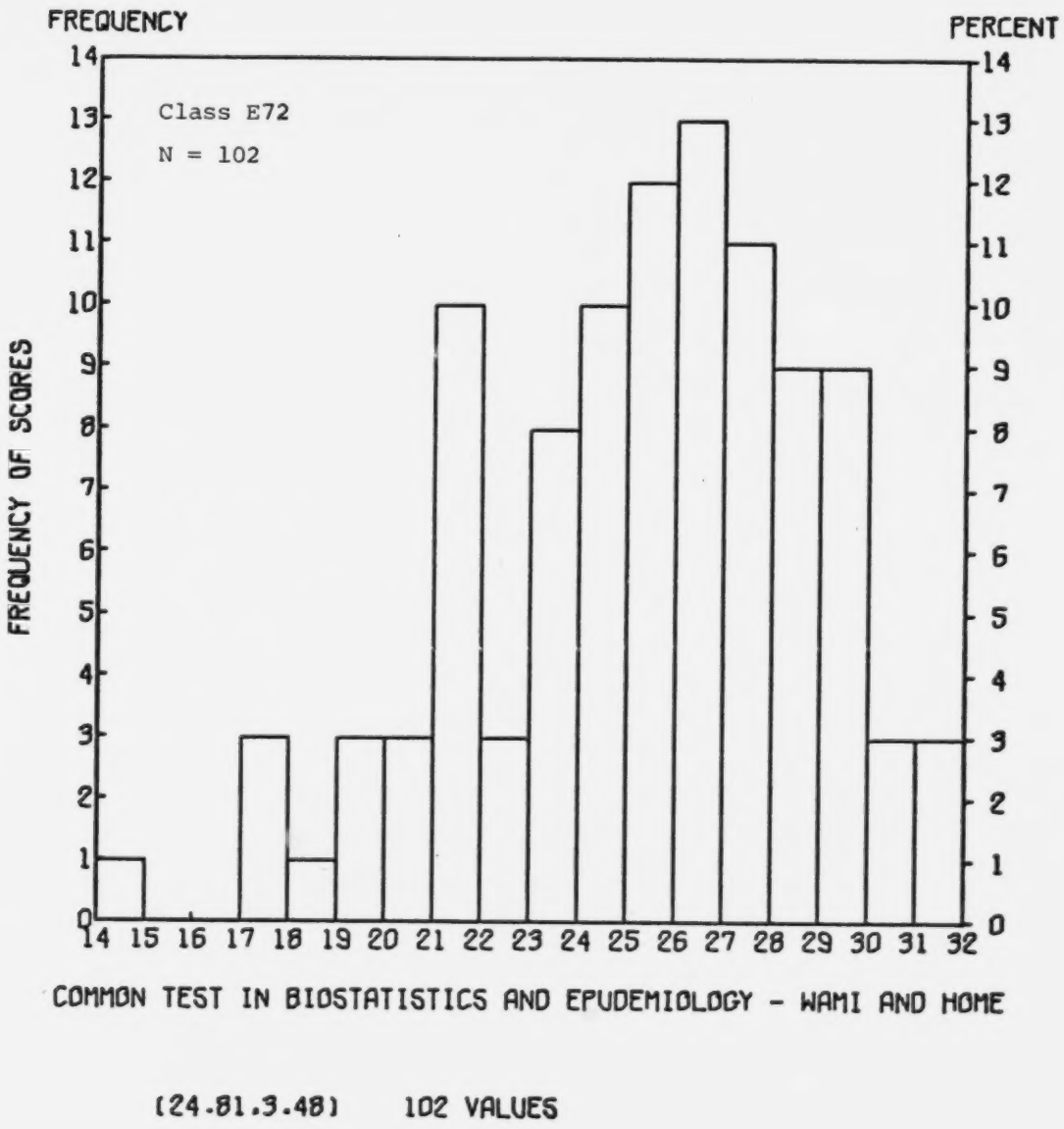

FREQUENCY
PERCENT
Class E72
N = 102
FREQUENCY OF SCORES
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14
14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32
COMMON TEST IN BIOSTATISTICS AND EPUDEMIOLOGY - WAMI AND HOME
(24.81.3.48) 102 VALUES

FIGURE 4.1 - FREQUENCY DISTRIBUTION OF SCORES FOR BIOSTATISTICS & EPIDEMIOLOGY COMMON TEST 1972

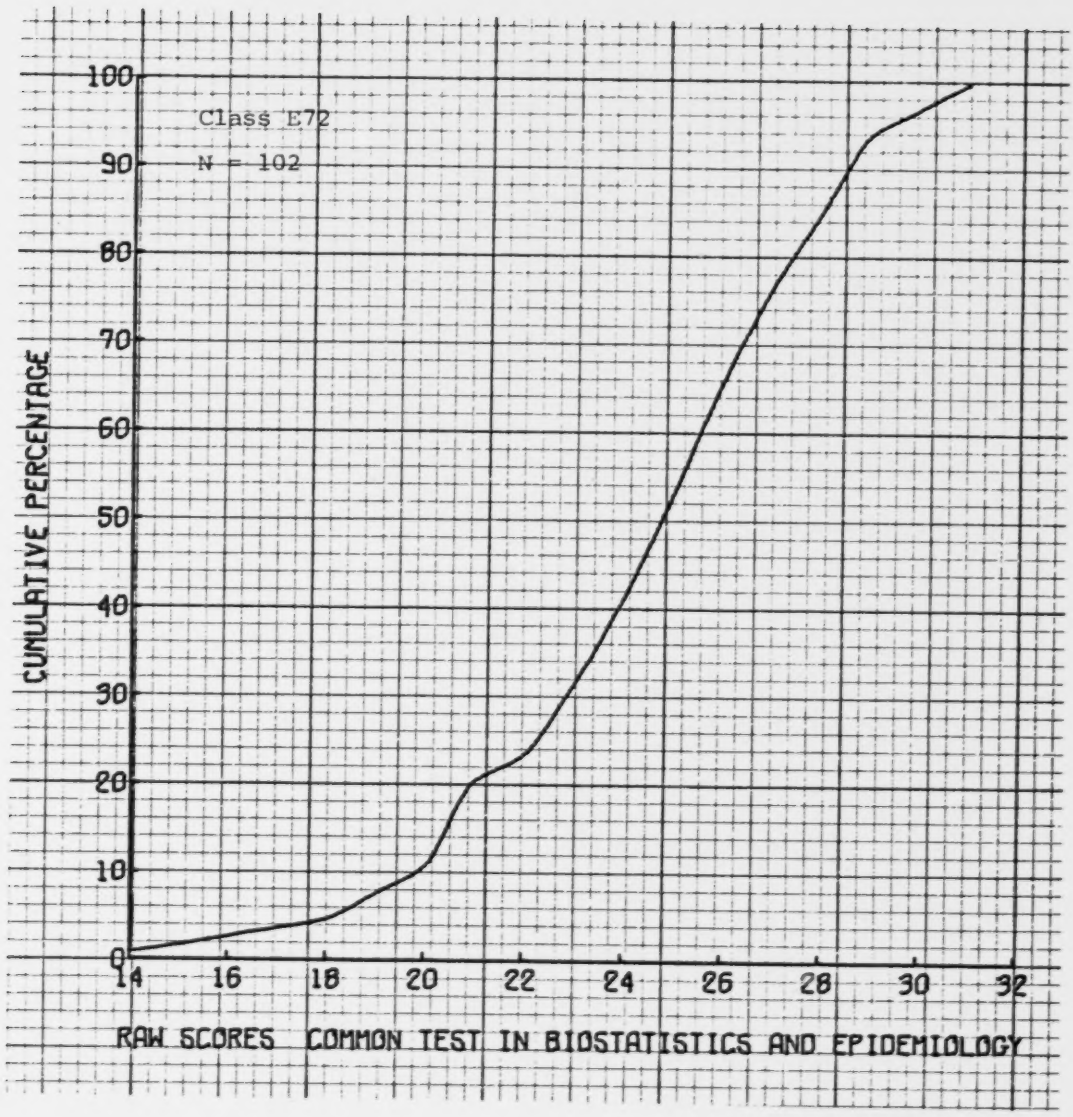


FIGURE 4.2 - PERCENTILE RANKS OF SCORES FOR BIOSTATISTICS & EPIDEMIOLOGY COMMON TEST 1972

TABLE 9.1

MEAN AND STANDARD DEVIATIONS FOR BIOSTATISTICS AND EPIDEMIOLOGY - PERIPHERAL SITE AND U OF W

Treatment Group	1	2	3	U OF W 4
Sample Size	9	9	11	73
Mean	22.000	22.667	24.818	25.425
Standard Deviation	4.213	2.598	3.868	3.227

TABLE 10

FREQUENCIES OF COMMON TEST SCORES FOR PERIPHERAL UNIVERSITIES

	Biochemistry		Anatomy		Physiology & Pharmacology		Biostatistics & Epidemiology	
	Score	Frequency	Score	Frequency	Score	Frequency	Score	Frequency
GROUP 1								
	60	2	40	2	38	2	28	1
	58	1	39	1	35	1	27	1
	55	2	38	1	34	1	26	1
	54	1	36	2	33	1	23	1
	52	1	35	1	31	1	21	1
	49	1	34	1	30	1	20	1
	47	1	33	1	28	1	19	1
					21	1	17	2
GROUP 2								
	71	1	41	1	34	1	28	1
	59	1	39	2	34	1	24	2
	56	1	38	1	33	2	23	2
	54	1	37	2	32	2	21	3
	51	1	34	1	28	1	19	1
	50	1	33	3				
	49	1				*		**
	41	1						
	39	1						
	38	1						
GROUP 3								
	63	1	44	1	33	2	31	1
	62	1	40	1	32	1	28	2
	61	1	39	3	30	2	27	2
	60	1	38	2	28	1	26	1
	59	1	37	2	27	2	24	1
	55	1	36	1	26	1	22	1
	52	2		**	25	1	21	1
	50	1			24	1	20	1
	44	1					19	1
	29	1						

* 3 students did not take exam
** 1 student did not take exam

DISCUSSION AND CONCLUSION

The evaluation of a program of the scale of WAMI is not completed until all questions are addressed. What has been presented here is an attempt to answer only immediate questions about the University Phase of WAMI. Data representing one quarter of the program has been presented. After several quarters it will be more appropriate to attempt definitive answers to many of the questions raised.

From data gathered during the first quarter, it seems appropriate to conclude that, as far as outcome in the cognitive areas are concerned, the students at the peripheral sites mastered the necessary and sufficient content as well as their classmates at the University of Washington. It is also important to note that, from the comparisons performed there is no consistent trend for student performance at any site to be different from the others. Differences in individual courses may arise from a number of sources including teacher differences, time differences, and material emphasis.

In making the comparison among the groups, Scheffe's method was used. This is a conservative test and may miss some differences. But, in our judgment, it is the test that best accomodates the discrepancy in sample sizes that the situation gives rise to.

The reliability of two of the common tests was not very high (.48 for Anatomy and .62 for Physiology/Pharmacology). It is expected that these indices will be increased with further refinement of the test item pool. Plans for this

refinement are under way. All faculty members involved met after the quarter was completed and discussed problems in course process and evaluation. A commitment has been made to increase the number of items in all courses (except Biochemistry, which doesn't need refinement) including Biostatistics and Epidemiology. If these commitments are met more precise instruments will be available for future evaluation.

Student attitude for this quarter has not yet been fully analysed. Data from informal conversations, preliminary survey of returned questionnaires, and completed structured interviews, suggest that students are extremely enthusiasitc and supportive of the program.

Faculty and preceptor attitude, measured pre, and post shows very little change. Their initial enthusiasm has not been dampened, nor were their expectations at the beginning unrealistic. They view the WAMI Program as enhancing their institution with much interest expressed by their non-participating colleagues.

The WAMI Program envisions a year of the basic science curriculum at the peripheral sites in the near future. Plans are already being formulated to expand to one year. The evaluation will be basically the same except there will be approximately fifteen courses instead of five. Summative evaluation in the cognitive area may take the form of a comprehensive test administered to all students at the end of the first year or beginning of the second. The National Board Mini-test is presently administered at the beginning of the second year and may be appropriate for summative evaluation.

Should the WAMI Program prove to be a viable and desireable way to educate mebical students, the participating WAMI states (Alaska, Montana, Idaho) would be expected to assume financial responsibility for educating their citizens. Because the WAMI Program may eventually attract more students from the states than is now possible, and may result in a more satisfactory distribution of physicians than currently exists it is hoped that the quality and availability of health care for all citizens of the WAMI area would be improved.